

The diagram shows a cross-sectional view of a circular particle accelerator. A central shaded region represents the particle path, with dashed lines indicating the dees structure and various components labeled 10a, 10b, 10c, 11a, 11b, 11c, 12, 2a, 2b, 2c, 3, 4, 5, and 8.

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## Method and portable system for locating mobile telephones

### Technical field

The present invention relates to a method to locate an active mobile telephone in a portable mobile telephone network according to the preamble of claim 1. Furthermore, the invention relates to a portable mobile telephone system according to the preamble of claim 5.

### Background to the invention

For instance when skiing, it may occur that unexpected avalanches surprise persons that may be buried under great amount of snow within a limited area. To locate these persons a number of different locating systems are presently used which are based on that the buried person has a special device attached to, for instance, his skiing-boots. This is not an active transmitter and a special equipment is needed to locate a person.

Today many persons carry their mobile phones when they are outdoors. Especially, this occurs more frequently when skiing, since this is a simple way to keep in touch over a large area. In US Patent No. 5,844,522 a system and a method is described for locating an active transmitter in a mobile network having stationary base stations.

### Summary of the invention

The problem with the existing locating systems is that only people having a special device may be located by the rescuing team in an avalanche since the amount of snow may stop the signals from the mobile telephone to reach a possible base station in the area. Many off-piste slopes, where avalanches

mainly occur, are situated at the side of the prepared ski runs and may have less coverage by the mobile telephone network.

5 The solution to the above mentioned problem is to provide a method for locating an active mobile telephone in a portable mobile telephone network according to claim 1 and a portable mobile telephone system according to claim 5.

10 An advantage with the present invention is that a person that end up in an avalanche, and that has a mobile phone turned on, may be located rapidly.

Another advantage with the invention is that there is no need for another locating device in case a person should end up in an avalanche.

15 Still another advantage with the invention is that the equipment needed to locate a mobile telephone is standardised, simple to manufacture, and furthermore, only a few functions is needed in the base station for making it work.

The invention will now be described in more detail with reference to the attached drawings.

## 20 **Brief description of the drawings**

Fig. 1 shows an embodiment of the present invention where the position of the mobile telephone is determined by the signal strength of the received signal.

25 Fig. 2 shows an embodiment of the present invention where the position of the mobile telephone mainly is determined by the direction of the received signal.

### Detailed description of the preferred embodiments

Figure 1 shows a schematic view of a portable mobile telephone network consisting of a transmitter 1, three receivers 2a, 2b and 2c, which are placed around said transmitter 1, preferably  
5 equally spaced around the transmitter.

The transmitter 1 has a transmitting area 3, within which a mobile telephone 4 may be contacted with some type of signalling 5, for instance a request for updating its position such as takes place in present mobile telephone systems. Each  
10 receiver has a reception area 10a, 10b and 10c, respectively, in the shape of a lobe, within which a transmitted signal from said mobile telephone may be received. These reception areas and said transmitting area together forms a coverage area 12 within which signalling 5 from the transmitter 1 may be  
15 received by the mobile telephone at the same time as a signal 11a-11c from said mobile telephone 4 may be received by all receivers 2a-2c.

By connecting the transmitter 1 and the receivers 2a-2c to a control unit 6, the signalling from the transmitter may be  
20 controlled at the same time as the received signal by each receiver, respectively, may be compiled and analysed.

In this embodiment of the invention, each receiver has built-in means to measure the signal strength of the received signal, which is forwarded to the control unit 6 for analysis.  
25 By comparing and weighting the received signal strength, which may be considered to be dependent on the distance between the mobile telephone and each receiver, respectively, a position may be determined for the mobile telephone 4.

Figure 2 shows an alternative embodiment of the present  
30 invention that differs from that in figure 1 in the following

way that it is only needed two receivers 2a and 2b. Each receiver has in this embodiment a much narrower lobe, 20 and 21, respectively, and a scanning function that allow the lobe to scan over a predefined angle 22 and 23, which results in that each receiver obtain a larger reception area 24 and 25, respectively.

Just as described above, a coverage area 26 is obtained when these reception areas and the transmitting area coincide.

Also in this embodiment there is a control unit 6 in which also an analysis of received signals is performed. Each receiver measures at which angle the received signal 11a and 11b, respectively, is strongest and send this information to the control unit, which may determine the position of the mobile telephone by triangulation. Furthermore, the measure information regarding each measured signal strength may also be forwarded to the control unit 6 for analysis to further add information when determining the position of the mobile telephone 4.

The receivers in this embodiment are a bit more complicated since they have a narrower lobe that has to be scanned over an area 24 and 25, respectively, at the same time as the received signal strength of the signal has to be monitored to determine the direction with the strongest signal strength.

The control unit 6, transmitter 1 and one of the receivers 2a may beneficially be arranged in an integrated main part of the system, which results in that the system only will consist of a main part and at least one additional receiver, which may have a very simple construction.

The system need only to be able to send out a signal, to which the mobile telephone automatically responds by in turn sending

out another signal. This requires the mobile telephone to be active.

**Claims**

1. A method for locating an active mobile telephone (4) in a portable mobile telephone network, said network comprising at least one portable transmitter (1) and at least two portable receivers (2a, 2b, 2c); and said network has a coverage area (12; 26), characterised in the followings steps:

- transmitting a request (5) from said transmitter to said active mobile telephone (4),
- receiving said request in said mobile telephone,
- 10 - transmitting a signal (11a,11b,11c) from the mobile telephone (4) caused by said request (5),
- receiving said signal in each respective receiver (2a,2b,2c), and
- 15 - analysing the received signals, whereby a positioning of said mobile telephone is done based on the received signals.

2. The method according to claim 1, wherein each of said receivers scans the area with at least one directional lobe, and that the analysing step calculates a direction for the received signal of each receiver (2a,2b).

3. The method according to claim 1 or 2, wherein each of said receivers measure the signal strength of the received signal, and that the analysing step compare the signal strengths and calculates which receiver is closed to said mobile phone (4).

25 4. The method according to any of claims 1-3, wherein said transmitted signal from said transmitter is selected to be a positioning updating signal.

5. A portable mobile telephone system, comprising a transmitter (1) and at least two receivers (2a,2b,2c) in a network which has a coverage area (12;26) and at least one active mobile telephone (4) within said coverage area, **characterised in** that the transmitter (1) has means for transmitting a request (5) to said active mobile telephone (4), which mobile telephone has means to receive said request (5) and transmit a signal (11a,11b,11c) caused by said received request, and where each of said receivers (2a,2b,2c) has means to receive said signal, and that said network further comprises an analysing equipment (6), whereby a positioning of said mobile telephone is done based on the received signals.

6. The portable mobile system according to claim 5, wherein each of said receivers has further means to scan said coverage area with at least one directional lobe so that said analysing equipment (6) may calculate a direction for the received signal by each of said receivers (2a,2b,2c).

7. The portable mobile system according to claim 5 or 6, wherein each of said receivers has further means for measuring the signal strength of the received signal so that said analysing equipment may calculate which receiver (2a,2b,2c) is closed to said mobile telephone (4).

8. The portable mobile system according to any of claims 5-7, wherein said means for transmitting a request (5) consist of means for transmitting a position updating signal.



2/2

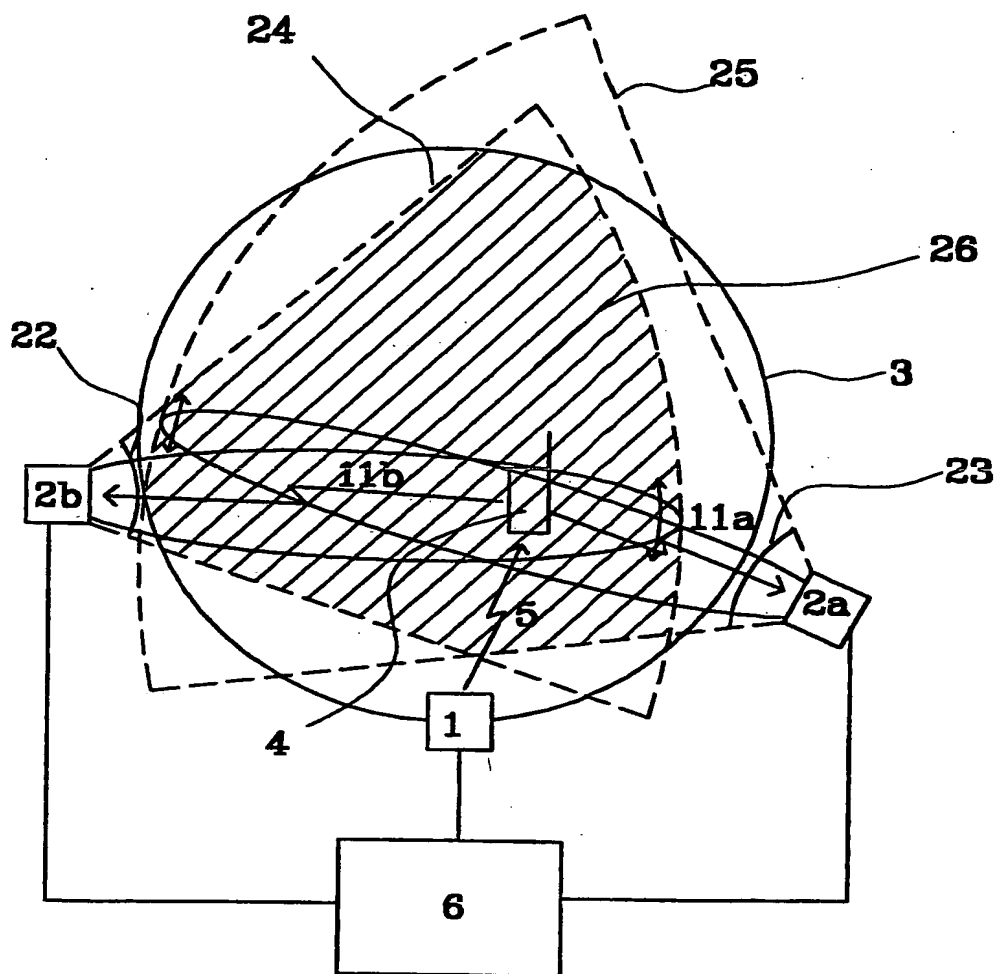


Fig. 2

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/00589

### A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96/02007 A1 (LOCKSHEED SANDERS, INC.), 25 January 1996 (25.01.96), page 4, line 29 - page 5, line 34; page 6, line 8 - line 20; page 6, line 33 - page 7, line 8, figure 1	1-8
A	US 4433335 A (DAVID W. WIND), 21 February 1984 (21.02.84), column 5, line 11 - line 40, figures 1, 3	1-8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.

PCT/SE 00/00589

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 96/02007 A1	25/01/96	NONE	
US 4433335 A	21/02/84	CA 1122686 A	27/04/82
		GB 1605053 A	16/12/81